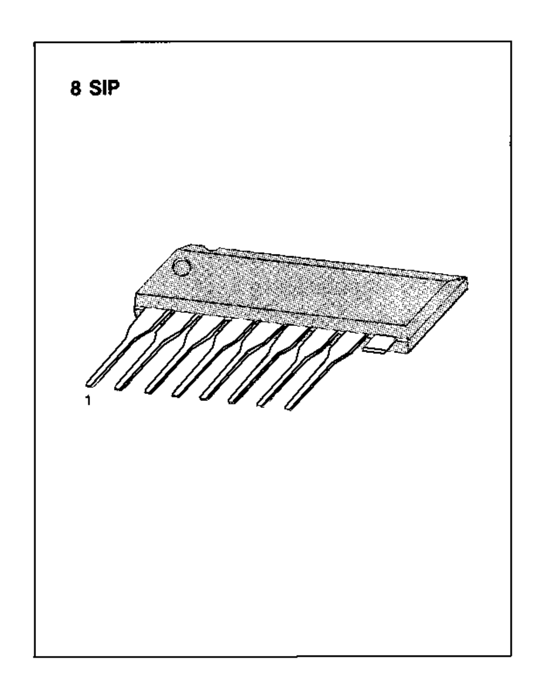
DUAL LOW NOISE EQUALIZER AMPLIFIER

The KA2221 is a monolithic integrated circuit consisting of 2-channel low noise amplifiers and regulated power supply for car stereos.

FEATURES

- Suitable for car stereos.
- **Low noise amplifier.**
- **Voltage regulator included.**
- **Good ripple rejection.**
- **High channel separation (65dB Typ).**
- **Minimum number of external parts required.**



ORDERING INFORMATION

Device	Package	Operating Temperature
KA2221	8 SIP	−20°C ~ +70°C

BLOCK DIAGRAM

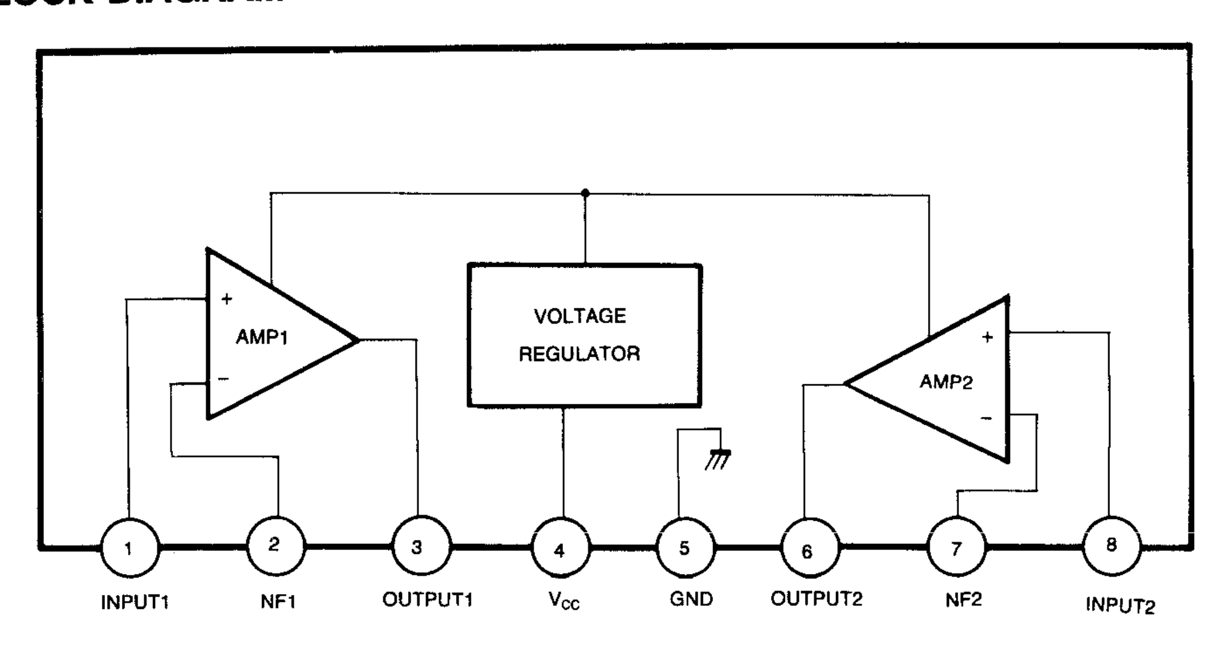


Fig. 1

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	18	V
Power Dissipation	P_D	200	mW
Operating Temperature	T_{OPR}	−20 ~ +70	°C
Storage Temperature	T_{STG}	−40 ~ +125	°C

ELECTRICAL CHARACTERISTICS

(T_a = 25°C, V_{CC}=12V, R_L=10KΩ, f=1KHz, NAB, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Quiescent Circuit Current	I_{CCQ}	V_I=0		6.0	9.0	mA
Open Loop Voltage Gain	G_{VO}		65	80		dB
Closed Loop Voltage Gain	G_{VC}	V_O=0.5V	33	35	37	dB
Output Voltage	V_O	THD=1%	0.6	1.0		V
Total Harmonic Distortion	THD	V_O=0.5V		0.1	0.3	%
Input Resistance	R_I			150		KΩ
Equivalent Input Noise Voltage	V_{NI}	R_G=2.2KΩ BW (−3dB)=15Hz ~ 30KHz		1.0	2.0	μV
Cross Talk	CT	R_G=2.2KΩ	50	65		dB

TEST CIRCUIT

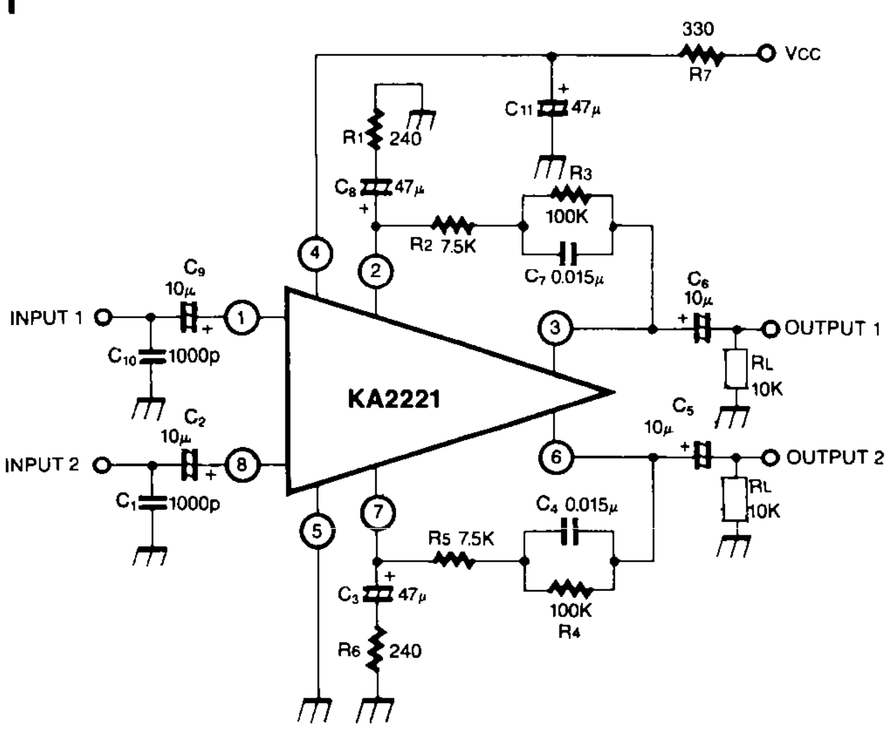
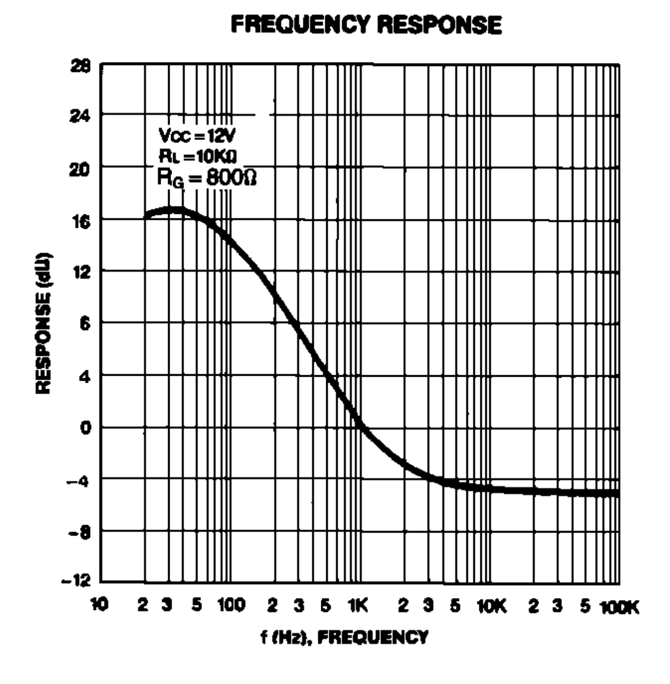
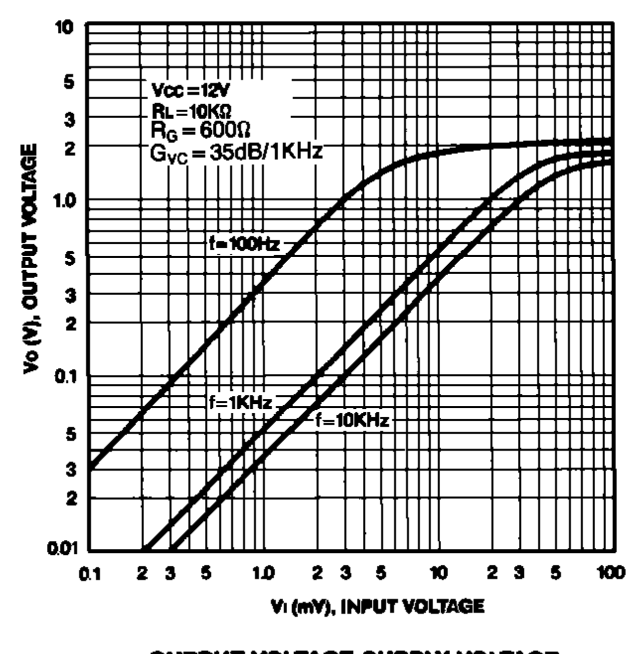
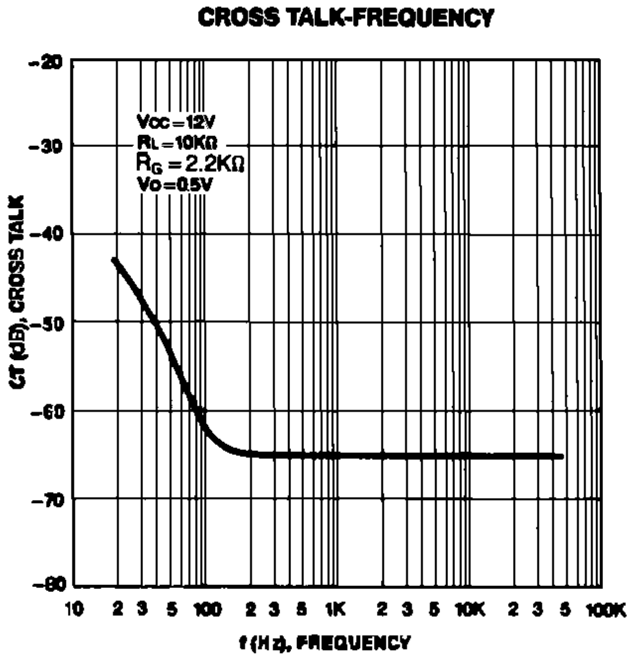
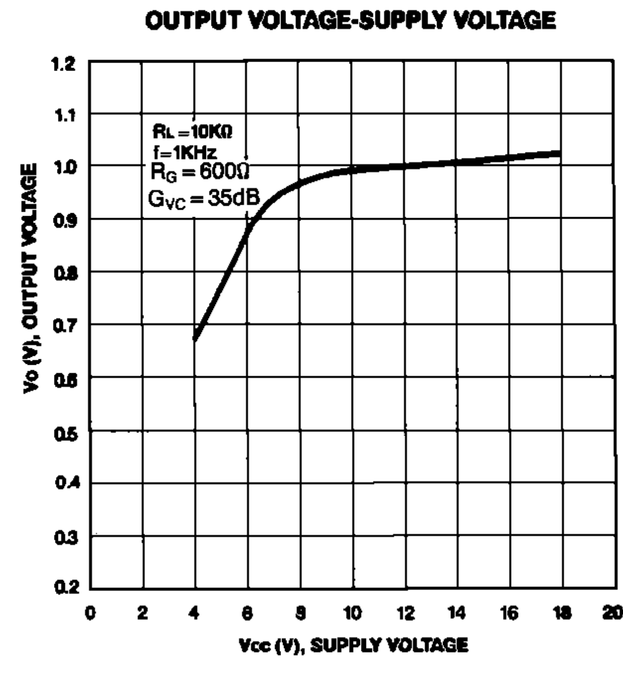


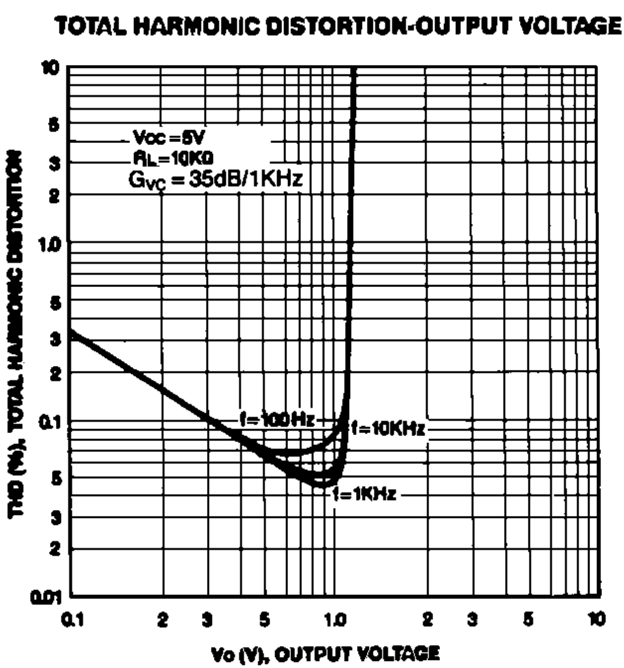
Fig. 2

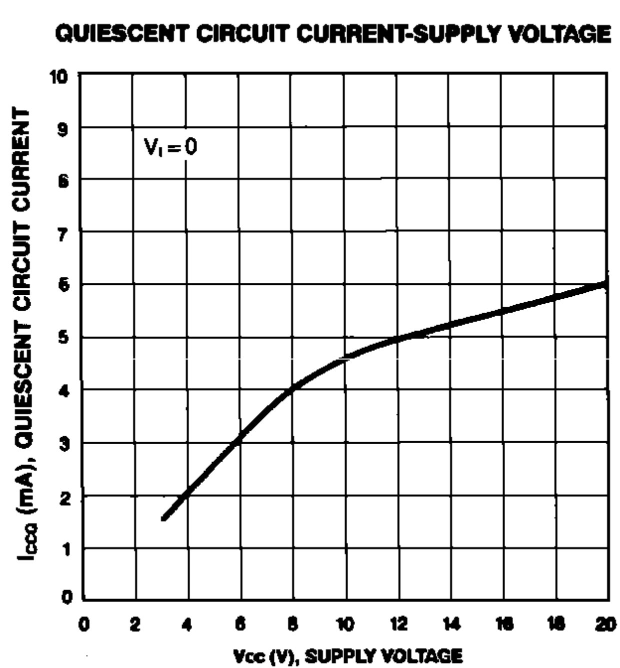

FREQUENCY RESPONSE
Vcc=12V
RL=10KΩ
RG=800Ω
RESPONSE (dB)
f (Hz), FREQUENCY


OUTPUT VOLTAGE-INPUT VOLTAGE
Vcc=12V
RL=10KΩ
RG=600Ω
GVC=35dB/1KHz
f=100Hz
f=1KHz
f=10KHz
Vo (V), OUTPUT VOLTAGE
Vi (mV), INPUT VOLTAGE


CROSS TALK-FREQUENCY
Vcc=12V
RL=10KΩ
RG=2.2KΩ
Vo=0.5V
CT (dB), CROSS TALK
f (Hz), FREQUENCY


OUTPUT VOLTAGE-SUPPLY VOLTAGE
RL=10KΩ
f=1KHz
RG=600Ω
GVC=35dB
Vo (V), OUTPUT VOLTAGE
Vcc (V), SUPPLY VOLTAGE


TOTAL HARMONIC DISTORTION-OUTPUT VOLTAGE
Vcc=6V
RL=10KΩ
GVC=35dB/1KHz
f=100Hz
f=10KHz
f=1KHz
THD (%), TOTAL HARMONIC DISTORTION
Vo (V), OUTPUT VOLTAGE


QUIESCENT CIRCUIT CURRENT-SUPPLY VOLTAGE
Vi=0
ICCQ (mA), QUIESCENT CIRCUIT CURRENT
Vcc (V), SUPPLY VOLTAGE

APPLICATION INFORMATION

External Components (Refer to test circuits)

C_1 (C_{10}): Noise filter
These capacitors prevent radio interference in strong electric fields. The recommended value is 1000pF.

C_2 (C_9): Input coupling capacitor
The recommended value is 10μF. If made too small, the low frequency characteristics will change for the worse, but too large a value will increase the rising time when power is applied.

C_3 (C_8): Negative feedback capacitor
The lower cut-off frequency depends on the value of these capacitors and is determined as follows:

$$C_3\ (C_8) = \frac{1}{2\pi f_L \cdot R_1\ (R_6)}$$

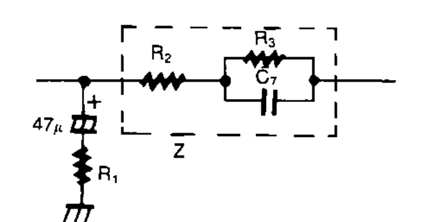
f_L: Low cut-off frequency
If the value of these capacitors is made larger, the starting time of amplifier is delayed further.

C_5 (C_6): Output coupling capacitor
The recommended value is 10μF.

R_2, R_3, C_7 (R_4, R_5, C_4): Equalizer network
The time constants of standard NAB characteristic are follow.

Tape speed	9.5cm/sec	4.75cm/sec
C_7 ($R_2 + R_3$) R_2, C_7	3180μsec 90μsec	1590μsec 120μsec

R_1 (R_6): Feedback component
The closed loop gain is determined approximately by the following relationship.



$$G_{VC} = 20 \log \frac{Z + R_1}{R_1} \quad \text{(dB)}$$

$$Z = R_2 + R_3 // C_7$$

* Choose R_2, R_3, (DC resistance of NAB element) as 100KΩ approximately.